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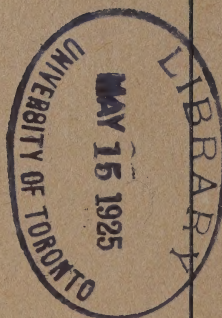
Canada Conservation Commission of
COMMITTEE ON WATER AND WATER POWERS

Niagara Power Shortage

BY

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The Niagara Power Shortage

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THIS paper considers, briefly, the present power shortage in the portion of Southwestern Ontario which is served from Niagara falls.

The extent to which consumption of electricity has increased may be judged from the increase in consumption by municipalities served from the Niagara system of the Hydro-Electric Power Commission of Ontario. When the Commission was initiating its operations, the late Premier, Sir James Whitney, though a staunch supporter of the project, stated to the Chairman, Sir Adam Beck, that the Commission would not require 10,000 h.p. The Commission's estimates of its yearly requirements have been amply vindicated.

Hydro-Electric Power Commission of Ontario	The Commission is directing the following systems: Niagara, Severn, Wasdell Falls, St. Lawrence, Smiths Falls, Ottawa, Port Arthur, Eugenia, Muskoka, Northern Ontario and Central Ontario. The capital investment of the province of Ontario in connection with these, and including the purchase price of the Ontario Power Company at \$22,450,000, and of the Central Ontario system at \$8,350,000, is approximately \$48,500,000. In addition, the municipalities have a total investment of over \$21,000,000 in connection with their local distribution and operating systems.
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The Commission serves over 121,000 customers of whom 117,000 are light, and 4,000 are power consumers. It supplies over 200 municipalities and operates about 3,000 miles of transmission lines. In short, over half the population of Ontario is supplied with electricity through its agency. Its contracts with the *municipalities* for the August 1917 load, total about 159,000 h.p. and the December 1917, load is estimated at about 201,000 h.p.

**Municipalities
Enthusiastic
Over System**

It has been authoritatively stated that, based on prices prevailing before the Commission's operations became effective, the estimated saving during 1916, to light users only, was over \$5,000,000. Notwithstanding statements by opponents of the Hydro-Electric Power Commission of Ontario that the project had not been a success, the various municipalities are enthusiastic over the success of the undertaking and the benefits which have resulted to them individually. Some 200 municipalities, served through the agency of the Commission, and which have invested some \$70,000,000, passed the following resolution at the Toronto meeting of the Ontario Municipal Electric Association on October 16th, 1917:

"We, the members of the Ontario Municipal Electric Association, desire to renew and reaffirm our fullest confidence in Sir Adam Beck and the Hydro-Electric Power Commission of Ontario, realizing his untiring efforts and his unselfish devotion to the interests of the people of this Province, and the magnificent results achieved by the Commission's honest and efficient administration of this great public service utility, and we pledge him our united support in his fight to conserve the rights of the municipalities in the Niagara and St. Lawrence rivers."

**Increase in
Consumption**

The yearly loads of municipalities in the Niagara district, including a few special industrial contracts made for long-term periods, are as follows:

1910.....	8,000 horse-power	
1911.....	12,000	"
1912.....	28,700	"
1913.....	50,470	"
1914.....	82,161	"
1915.....	110,654	"
1916.....	150,000	"
1917 (estimated).....	205,000	"
1918 (estimated).....	250,000	"

**An Acute
Shortage**

The present available supply of power for the 200 municipalities served by the Hydro-Electric Commission is exhausted. The shortage is acute. In October, 1917, the Secretary of the Commission sent an official notice to municipalities advising that, pending completion of the inquiry by Sir Henry Drayton respecting the power situation at Niagara Falls, as well as the inquiry held before the three judges appointed under the Water-powers Regulation Act, "no further contracts be entered into for a supply of power nor for an increase in the load of the present power users."

**Growing
Demand in
Toronto**

The Toronto Hydro-Electric Commission obtains power from the Hydro-Electric Power Commission of Ontario and distributes it in Toronto. It commenced operations June 1, 1911, with about 400 customers. At present (November, 1917) it has over 50,000 customers and has expended about \$8,000,000. To take care of the December, 1917, load will require about 75,000 h.p., but only about 50,000 h.p. is available.

The Toronto Commission is exerting every effort to compress its load, and to prevent even the natural increase in the requirements of its present customers. It can take on no new customers and has been issuing special appeals to present customers to use as little current as possible, particularly from 4.30 p.m. to 6 p.m.

"on Mondays, Tuesdays, Wednesdays, Thursdays and Fridays, and so help to avoid a possible power shortage for munition plants and other essential industries. . . . Every economy, however small, will help to achieve the result aimed at. If each of the 50,000 Hydro customers in Toronto uses even one or two lights less during these hours, it will mean a greater reduction than if the whole of the street lights in Toronto were turned off."

Undoubtedly, much power and light are absolutely wasted. Not very long ago, the vendors of electric energy were offering special inducements to encourage consumption, and customers were invited to use new electric devices as rapidly as such could be invented. The public has responded to these invitations and now, assuming that there is no set-back to industrial activity, Ontario is faced with a power shortage which, until relieved, must constitute a serious check to her industrial growth. The time is at hand when drastic action must be taken to curtail the use of electric energy now employed on luxuries, and thus make it available for necessary purposes.

**Making
War Materials**

The average individual has little idea of how diverse and extensive are the demands upon manufacturers for materials of war. A recent photograph shows a French soldier at his post with such individual equipment as: rifle, grenade-throwing gun, pistol, package of powder to be used against gas, a basket of hand grenades, sand bag, pickaxe, gun-grenades, signal lantern, alarm bell for gas attacks, small reel of barbed wire, rocket scoop, corrugated iron hatch-grate, shovel, wire-scissors, broom, gun-carrier with periscope, and a gabion.

The Ontario Hydro-Electric Commission at such centres as Niagara Falls, Welland, Toronto, Hamilton, Dundas, London, St. Catharines, Brantford, Kitchener, St. Thomas, Stratford, Guelph,

Galt, Sarnia, Woodstock, Paris, Preston, Walkerville, Wallaceburg, Seaforth, etc., is supplying power for manufacturing munitions of war such as abrasives, aeroplanes, aluminium, beds, blankets, boots, brass sockets, brushes, camp ranges, carbide, castings, chemicals, clothing, cloth wire, cutlery, flour, fuses, harness, kit bags, primers, provisions, rifles, shells, shell parts, shell boxes, shell-making machinery, special lanterns, steel plugs, special tools, waggon, etc.

The uses to which electric energy in large quantities is applied in the electro-chemical industries, are well described by a statement recently made by Mr. F. J. Tone of the Carborundum Company, Niagara Falls, N.Y. He says:

"The part set for Niagara industries in the war programme is a large one. They must supply the bulk of the ferro-alloys, the all-essential of the steel industry. Ferro-chrome is wanted for armour plate and projectiles. The army must have chlorine for gas shells, camp sanitation, water purification and for the Dakin solution. Explosive makers want caustic soda, potassium chlorate and chlorobenzol. Dirigibles require silicon for generating hydrogen. Destroyers want phosphorous for smoke screens. Abrasives, cyanides, aluminium, electrodes and many other products are urgently needed in the war game. The Aircraft Production Board has decided on the design of the standardized United States aeroplane motor. It will require quantities of ferrochrome for chrome-steel crank shafts, chrome-steel connecting rods and all parts subjected to the enormous strains of a mechanism weighing less than 2 lbs. per horse-power. Quantities of aluminium will go into crank-cases and pistons. The modern grinding wheel alone makes possible the finishing to limits of a fraction of a thousandth of an inch all parts of the aeroplane engine and, thus, the artificial abrasives of Niagara become the key to interchangeability."

In August, the munition plants supplied with power by the municipalities and the Commission from the Niagara system were taking a total of over 78,000 h.p. with *firm* contracts amounting to 94,600 h.p. Some of this power cannot be supplied without cutting off other customers. Additional present demands from the Union Carbide Co., the Electro Metals Co., and other munition manufacturers, total over 45,000 h.p. In August, the Ontario Power Co. was supplying some 44,600 h.p. for munitions and war materials. This makes a total demand upon the Hydro-Electric Power Commission and the Ontario Power Co. for munitions, of over 186,000 h.p. Of this, however, 30,000 to 35,000 h.p. may be considered as 'off-peak' power, leaving a net requirement of some 150,000 to 155,000 h.p.

The shortage on the Niagara system for munition plants supplied with power by the Commission and the municipalities alone, considered by themselves, may be placed at about 65,000 h.p. It is very interesting to note that, as a result of the campaign conducted through the daily press and by means of other agencies, the various municipalities have so adjusted consumption of electricity within their respective jurisdictions as to reduce the load *on peak* by from 20,000 to 30,000 h.p.

Relief of
Shortage

The following are some of the means by which this shortage may be supplied:

1. Increased utilization of steam power. This, at the present time, is out of the question as a means of dealing with the problem as a whole.

2. Supplying temporarily, water from the unappropriated surplus, thus permitting the utilization of the excess capacity of the plants at Niagara. It has been stated in the press that this has been provided for.

3. Curtailment of the power now used for street and other lighting, such, for example, as ornamental lighting; also for certain power purposes, in order to liberate more power for manufacture of munitions.

4. Utilizing the water of existing plants under more efficient conditions, such as will exist in connection with the new Chippawa project, which will operate under a head of 300 to 305 feet. It will, however, be approximately three years before relief can be obtained by such means.

The Hydro-Electric Power Commission of Ontario is moving as rapidly as possible to have additional equipment, including pipeline, installed, so as to have available in about ten months, an additional 50,000 h.p. from the plant of the Ontario Power Co.

5. Limitation of the quantity of power at present being exported from Canada to the United States. As manufacturers of war munitions in the United States also are short of power, such limitation will require very careful consideration in its international aspects, so that full justice will be done to interests on both sides of the boundary.

Chippawa
Project

The new Chippawa project which the Hydro-Electric Commission has started will, with the surplus water available, provide about 200,000 h.p., but, as stated above, cannot be available for approximately three years. The proposed size of the individual units, namely, 50,000 h.p., is larger than in any other hydraulic development in the world.

Considerations of efficiency and desirable operating characteristics which it would be impossible to obtain with smaller units, have prompted the adoption of such large units. Power is to be produced at considerably lower cost than \$9.00 per h.p. per year, which the Commission has been paying the Ontario Power Co. for the 100,000 h.p. covered by the original contract.

As the Hydro-Electric Power Commission of Ontario now controls the Ontario Power Company, the unused water allotted to the Ontario Power Company will, it is stated, be diverted to augment the water supply available for the Chippawa project. If so, the capacity of the new Chippawa plant will be about 300,000 h.p. instead of the 200,000 h.p. above mentioned.

Preliminary work upon this project, embracing surveys and other engineering activities, has been carried on during the last three years. Plant-equipment and tools for carrying out the work of construction were purchased some time ago and much of this equipment is on the ground ready for operation.

The table given below includes the quantities of power available, capable of development, exported, used for munitions, etc. In considering these figures, it should be fully understood that they vary from day to day. In many instances, they have been derived from data supplied through the courtesy of the Hydro-Electric Power Commission of Ontario. They are representative of conditions as in October, 1917, and are the latest available.

The capacity of the large power plants in Canada at Niagara Falls may be stated as follows:

	Rated capacity of present installation	Approximate maximum generation capacity
Canadian Niagara Power Co.....	112,500 h.p.	100,000 h.p. (a)
Ontario Power Co.....	159,000 h.p.	162,000 h.p. (b)
Electrical Development Co.....	135,800 h.p.	125,000 h.p. (c)
	407,300 h.p.	387,000 h.p.

The combined loads of the Ontario Power Company and the Ontario Hydro-Electric Commission are ^(d):

Total connected load.....	519,000 h.p.
Required for the December 1917 load.....	311,000 h.p.
Required generator capacity for this December load.....	300,000 h.p.

(a) At times, has generated about 103,000 h.p.

(b) At times, has generated about 163,000 h.p.

(c) At times, has generated 146,000 h.p., but it is claimed that the water used to generate this amount exceeds the quantity legally usable to generate the 125,000 h.p. specified in the contract.

(d) Includes the export of the Ontario Power Co. to the United States.

The total power supply of the Ontario Hydro-Electric Commission, and the Ontario Power Company is as follows:

Ontario Power Co.....	160,000 h.p.
Contract with Canadian Niagara Power Co.....	50,000 h.p.
Contract with Electrical Development Co. (a).....	13,500 h.p.
Contract of Ontario Power Co. with Electrical Development Co. (b).....	13,500 h.p.
Total capacity, Oct. 31, 1917.....	237,000 h.p.

The power requirements in December, 1917, of the Hydro-Electric Power Commission of Ontario, Niagara system, are as follows:

Hydro-Electric Comm'n, and Ontario Power Co., in Niagara district.....	261,078 h.p.
Contract with the Niagara, Lockport and Ontario Power Co.....	60,322 h.p.
Maximum power demand.....	321,400 h.p.
Power capacity to serve Canadian loads (c).....	246,000 h.p.
Power for Niagara, Lockport and Ontario Power Co., contract (d)...	50,000 h.p.
Power actually required.....	296,000 h.p.

Power available to Hydro-Electric Commission and Ontario Power Co., to serve above loads, ^(e) is:

Capacity of Ontario Power Co.....	163,000 h.p.
Purchase from Canadian Niagara Power Co.....	50,000 "
Contract with Electrical Development Co.....	13,500 "
Total power actually available of.....	226,500 "
Thus the shortage of power for present customers and firm contracts is—296,000 h.p. less 226,500, namely.....	69,500 h.p.

Exportation of Electricity

Consideration of any proposal to curtail the export of electrical energy from Niagara requires a critical examination of the underlying factors. Much has been said respecting reduction of the amount of electric energy exported to the United States and much misunderstanding has arisen in this connection. The Chairman of the Ontario Hydro-Electric Power Commission has been urging the retention in Canada of a sufficient amount of Niagara power to assist in meeting the present exigencies. If, for example, the amount retained be such as will equalize the quantities utilized in each country, then, our exports would be reduced by about 63,250 h.p.—not, as frequently

(a) This contract, which is that of the Ontario Power Co., expires Oct., 1920.

(b) Expired Oct. 31, 1917, but supply is being temporarily continued subject to new agreement.

(c) Taking account of diversity of load.

(d) By agreement with Hydro-Electric, reduced from 60,000 h.p. during the war.

(e) Assuming contract with Electrical Development Co. is terminated Oct. 31, 1917. As stated above, this energy is being supplied temporarily, subject to new agreement.

stated, 125,000 h.p. The analysis presented below indicates a basis upon which the equity in advantages and disadvantages of present conditions at Niagara, *per se*, may be weighed.

The quantities of electrical power at present being exported to the United States are as follows:

Ontario Power Co.	35,000 to 60,000 h.p.
Canadian Niagara Power Co.	30,000 to 42,000 "
Electrical Development Co.	22,000 to 27,000* "
Total export of about.	125,000 h.p.

PROVISIONAL BALANCING OF POWER GENERATED AT NIAGARA FALLS ON
BOTH SIDES OF INTERNATIONAL BOUNDARY

United States:

Niagara Falls Power Company.	100,000
International Paper Co.	10,000†
Hydraulic Power Company.	150,000
Cataract City Milling Co.	1,000‡
Pettebone Cataract Paper Co.	4,000‡

Total power generated on United States side. 265,000 h.p.

Canada:

Ontario Power Company.	162,000
Electrical Development Company.	125,000
Canadian Niagara Power Company.	100,000
International Railway Co.	1,500

Total power generated on Canadian side. 388,500 h.p.

Total power generated—United States and Canada.. 653,500 h.p.

One-half total power generated is. 326,750 h.p.

Niagara power used in the United States. 390,000 h.p.

Thus, according to the above analysis, the United States would be utilizing 63,250 h.p. in excess of half of the total amount of power generated, and the retention of this in Canada would make the quantities used in both countries equal.

Canada is exporting electric energy from New Brunswick to the state of Maine; from Quebec to New York; from Ontario to New York and Minnesota, and from British Columbia to Washington.

As pointed out a year ago, no country need be expected to send out of its borders that which is essential to its own existence. Having in mind the present coal situation, it is unnecessary to emphasize the vital importance to Canada of this international fuel and power question.

Canadians should appreciate the fact that the United States has been dealing with them generously in the present distressing

*Embracing 13,500 h.p. 'on-peak' and 8,000 h.p. 'off-peak' power.

†Chargeable to allotment of Niagara Falls Power Co.

‡Chargeable to allotment of Hydraulic Power Co.

coal situation. Portions of the United States are as badly off for coal as portions of Canada. Between the United States and Canada there is exchange of many natural and manufactured products, and the problems which arise, from time to time, in connection with such interchange can be satisfactorily solved, and the whole situation reduced to a good working basis. Canada, however, must conserve against the day of her own need, such resources as are available for barter. These problems call for the best statesmanship which Canada can bring to bear upon them, and, only by a knowledge of all facts relating to the subject, can a wise administrative policy respecting our fuel and power problems be formulated and carried out.
